REMARKS

The Office Action of September 21, 2004 has been received and its contents carefully considered.

Claims 1 to 6, 9 to 12, 14 to 24 and 26 to 30 are all the claims pending in the application.

With respect to applicants' claim for benefit to Provisional Application No. 60/308,855 filed on August 1, 2001, the Examiner states that applicant must supply an English translation of the Provisional Application.

Applicants enclose a copy of a stamped filing receipt showing that applicants filed the English translation in the Provisional Application 60/308,855 on June 10, 2002. This is all that is required for applicants to claim the benefit of the Provisional Application. Nevertheless, applicants enclose herewith a copy of the English translation of the Provisional Application 60/308,855.

In Paragraph 5 of the Office Action, claims 21 to 24, 26, 29 and 30 have been rejected under the first paragraph of 35 U.S.C. § 112 as failing to comply with the written description requirement.

In Paragraph 6 of the Office Action, the Examiner rejects these same claims under the first paragraph of 35 U.S.C. § 112 as being based on a non-enabling disclosure.

In each of these rejections, the Examiner objects to the term "an electrode...the electrode being provided on each surface of the electrolyte membrane.".

The Examiner states that the specification discloses first and second electrodes formed on opposite sides of the electrolyte membrane of the membrane-electrode assembly (MEA), but does not disclose an electrode that is provided on each surface of the electrolyte membrane.

Applicants first point out that the language to which the Examiner has objected appears in original claim 17 and in paragraph (17) at page 7 of the specification. Accordingly, it is clear that the specification does provide a written description of the language to which the Examiner has objected.

Further, applicants submit that one of ordinary skill in the art would understand the language to which the Examiner has objected as meaning that first and second electrodes are provided on opposing sides of the electrolyte membrane.

Applicants note that the Examiner has not included claim 17 in these rejections. Applicants assume that this was an oversight on the part of the Examiner.

Although applicants submit that the present specification provides a written description of the objected to language, and that the specification is enabling for the objected to language, applicants have amended each of the independent claims 17, 21, 22 and 29 to state that the electrode membrane has first and second surfaces, that a first electrode is on the first surface and a second electrode is on the second surface, and wherein each electrode includes a catalyst layer.

In view of the above, applicants submit that the specification provides a written description of the present claims and that the present claims are based on an enabling disclosure. Accordingly, applicants request withdrawal of this rejection.

Claims 21 to 24 and 26 have been rejected under the first paragraph of 35 U.S.C. § 112 as (a) being based on an enabling disclosure and (b) failing to comply with the written description requirement for the following reasons.

The Examiner states that the conductive powder particles disclosed in the present application are present in the catalyst layer and, at best, appear to contact a surface of the gas diffusion layer as shown in Figure 6. The Examiner asserts that the gas diffusion layer itself does not contain any conductive powder particles.

The Examiner states that he has interpreted the claims in view of the teachings in the specification to mean that the conductive powder particles defined in these claims are present in the catalyst layer shown in Figure 6, and not in the gas diffusion layer.

Applicants submit that the Examiner has misinterpreted the teachings of Figure 6 and the specification.

Figure 6 is described in the specification at page 23, line 28 to page 24, line 11.

As explained in this portion of the specification, Figure 6 shows a catalyst layer 10, comprising catalyst bearing carbon particles 12, a gas diffusion layer 9, a conductive porous

substrate 8, conductive powder particles 14, and fibrous carbon 13. As can be seen in Figure 6 itself, the gas diffusion layer 9 is comprised of the fibrous carbon 13 and the conductive powder particles 14. As shown in Figure 6, a number of the conductive powder particles 14 are at the surface of the gas diffusion layer which is in contact with the catalyst layer formed by the catalyst bearing particles 12. The Examiner simply is mistaken when he states that the gas diffusion layer does not contain any conductive powder particles. The conductive powder particles shown in Figure 6 clearly are present in the gas diffusion layer 9.

Further, the present specification at page 17, lines 3 to 5, states that the gas diffusion layer includes conductive powder particles.

Further, the present specification at page 22, lines 8 to 17, states that a composition containing the conductive powder particles, the hydrophobic resin and the fibrous carbon preferably assumes the form of a paste, and a gas diffusion layer is formed by applying the paste onto the conductive porous substrate. Again, this disclosure clearly states that the gas diffusion layer contains the conductive powder particles.

In view of the above, applicants submit that it is clear that the present specification discloses embodiments in which a gas diffusion layer contains conductive powder particles, and that these particles would be at the surface in contact with the catalyst layer.

In view of the above, applicants request withdrawal of this rejection.

Claim 1 has been rejected under 35 U.S.C. § 102(b) as anticipated by the newly cited JP 62-287571.

The Examiner states that JP '571 discloses a gas diffusion electrode comprising a water repellant PTFE layer with vapor grown carbon fibers. The Examiner states that the gas diffusion electrode is used in a battery, and is provided with a catalyst layer to impart the required catalytic activity to the electrode.

The Examiner further states that an oral translation of JP '571 shows that the carbon fibers have a thickness of 200 to 500 Angstroms, which is equivalent to 20 to 50 nanometers. The Examiner refers to the underlined text on page 323 of JP '571.

The Examiner further states that he has requested a translation of this document, and that he will send a translation when he receives it.

Applicants have not received an English translation of JP '571 from the Examiner.

The present invention as set forth in claim 1 as amended above is directed to a fuel cell comprising an electrolyte sandwiched by electrodes having a catalyst layer and a gas diffusion layer, or an assembly for a fuel cell comprising an electrolyte sandwiched by electrodes having a catalyst layer and a gas diffusion layer, characterized in that (i) the catalyst layer comprises ~~a~~ catalyst-bearing conductive powder particles and a graphitized vapor grown carbon fiber having a fiber filament diameter of 10-300 nm, and/or (ii) the gas diffusion layer comprises a layer containing a water repellant resin and a graphitized vapor grown carbon fiber having a fiber

filament diameter of 10-300 nm, and wherein at least part of the surface of the gas diffusion layer is in contact with the catalyst layer.

Thus, applicants have amended claim 1 to recite that the vapor grown carbon fiber is graphitized.

JP '571 does not disclose or suggest the graphitized vapor grown carbon fiber that is employed in the present invention.

As disclosed in the present specification at page 20, line 28 to page 21, line 1, with respect to the carbon fiber employed in the gas diffusion layer, when vapor grown carbon fiber (VGCF) is heat-treated at 2,000°C or higher, not only electrical conductivity but also characteristics such as chemical stability and thermal conductivity are improved. Therefore, when the thus-treated VGCF is used in combination with a catalyst for a fuel cell, power-generating efficiency (the amount of power generated on the basis of unit volume) of the resultant fuel cell is enhanced, and durability of the fuel cell (the ratio of the maximum power of the cell after continuous use for 1,000 hours or more to the initial maximum power of the cell) is also enhanced.

As disclosed in the specification at page 21, lines 2 to 10, particularly when VGCF is heat-treated at 2,500°C or higher, the resultant VGCF of high crystallinity exerts remarkable effect of enhancing such fuel characteristics. Therefore, in the present invention, the degree of graphitization-crystallization of VGCF is enhanced by means of addition of boron. Mixing of a

boron compound and VGCF may be carried out by means of any method without use of a special apparatus, so long as they are carefully mixed so as to form a uniform mixture.

See also the description at page 17, lines 9 to 28 with respect to the graphitized vapor grown carbon fiber that is used in the catalyst layer.

Since JP '571 does not disclose or suggest a graphitized vapor grown carbon fiber, applicants submit that JP '571 does not disclose or render obvious the subject matter of claim 1.

In view of the above, applicants submit that JP '571 does not disclose or suggest the subject matter of claim 1 and, accordingly, request withdrawal of this rejection.

Claims 1, 17, 18, 21, 27, 29 and 30 have been rejected under 35 U.S.C. § 103(a) as obvious over EP '638 in view of JP '571, as set forth in Paragraph 15 of the Office Action.

Applicants submit that EP '638 and JP '571 do not disclose or render obvious the subject matter of the above claims and, accordingly, request withdrawal of this rejection.

The Examiner asserts that EP '638 discloses all of the recitations of the present claims, except that EP '638 does not disclose that the carbon fibers in the gas diffusion layer are vapor grown carbon fibers having a fiber filament of 10 to 300 nm.

The Examiner relies on JP '571 for a teaching of a gas diffusion electrode comprised of PTFE and vapor grown carbon fibers having a fiber filament of 200 to 500 Angstroms, that is, 20 to 50 nm. The Examiner argues that it would have been obvious to employ this gas diffusion

layer of JP '571 in the gas diffusion electrode of EP '638 because JP '571 discloses that such a gas diffusion layer improves the gas permeability and electrical conductivity of the gas diffusion layer.

As discussed above, applicants have amended claim 1 to recite that the vapor grown carbon fiber is graphitized. Applicants have similarly amended independent claims 17, 21 and 29.

Thus, applicants have amended independent claims 17, 21 and 29 to recite that the vapor grown carbon fiber is graphitized.

EP '638 discloses a fuel cell that contains carbon fiber. However, the carbon fiber of EP '638 is a general carbon fiber (φ=20 μm or more), and is completely different from the graphitized vapor grown carbon fiber (graphitized VGCF) of the present invention.

The carbon fiber of EP '638 is a thick and long carbon fiber and the surface thereof is uneven. Also, the diameter is different. The fiber length determined from diameter and aspect ratio has an important meaning as can be seen from the present specification, as described below.

Furthermore, the graphitized VGCF of the present invention is excellent in electrical conductivity and crystallinity and has poor wettability. That is, VGCF of the present invention is excellent in water repellency and electrical conductivity. Accordingly, the present invention has a remarkable effect as a fuel material.

Thus, as disclosed in the present specification at page 18, lines 6 to 27, examples of fibrous carbon include PAN-based fibrous carbon, pitch-based fibrous carbon, vapor grown fibrous carbon, and carbon fiber having a fiber filament diameter nanometers, which is called "nano-tube." However, since pitch-based carbon fiber or PAN-based carbon fiber has a long fiber filament length, the carbon fiber is not uniformly mixed with a catalyst easily. Therefore, in consideration of uniform mixing with a catalyst and conductivity, a nano-tube or vapor grown carbon fiber (hereinafter the fiber may be abbreviated as "VGCF") is preferably used. Particularly, VGCF which has been heat-treated and exhibits enhanced electrical conductivity is preferred, since the VGCF has appropriate elasticity. As discussed above, the VGCF employed in the present invention is graphitized.

As discussed above, JP '571 does not disclose or suggest the graphitized vapor grown carbon fiber that is employed in the present invention. Accordingly, the combination of the teachings of EP '638 with those of JP '571 would not lead one of ordinary skill in the art to the present invention.

In view of the above, applicants submit that EP '638 and JP '571 do not disclose or suggest the subject matter of the above claims and, accordingly, request withdrawal of this rejection.

Claims 1, 17, 18, 21 to 24, 26, 27, 29 and 30 have been rejected under 35 U.S.C. § 103(a) as obvious over EP '638 in view of JP '571, and in view of the newly cited U.S. Patent 6,489,026 to Nishimura et al.

In this rejection, the Examiner employs the same reasoning as set forth in Paragraph 15 above for claims 1, 17, 18, 21, 27, 29 and 30, and relies on the teachings of Nishimura et al for the recitations of claims 22, 23, 24 and 26.

With respect to claim 22, applicants point out that it has been amended to state that the vapor grown carbon fiber is graphitized. Thus, claim 22 contains the same recitations as in claim 17, and further recites the amount of vapor grown carbon fiber. Claims 23, 24 and 26 depend from claim 22. Accordingly, applicants submit that these claims are patentable for the same reasons as discussed above with respect to independent claim 17.

Further, the Examiner states at page 11 of the Office Action that Nishimura et al disclose gas diffusion electrodes at column 11, lines 48-54, but such a description is not found in Nishimura et al. Nishimura et al relate to an invention mainly used for a lithium battery, and a description regarding a fuel cell is not present in Nishimura et al. See, for example, column 1, lines 16 to 27, column 11, lines 28 to 33 and Example 7 of Nishimura et al. In this respect, the Examiner seems to have a misunderstanding. Accordingly, applicants submit that one of ordinary skill in the art cannot arrive at the subject matter of the presently claimed invention even if the teachings of Nishimura et al are combined with the teachings of EP '638 and JP '571,

because there is no teaching in any of the references to employ a graphitized vapor grown carbon fiber in a fuel cell or in a membrane-electrode assembly for a fuel cell.

In view of the above, applicants submit that EP '638, JP '571 and Nishimura et al do not disclose or suggest the subject matter of the rejected claims and, accordingly, request withdrawal of this rejection.

Claims 19 and 20 have been rejected under 35 U.S.C. § 103(a) as obvious over EP '638 in view of JP '571 and Nishimura et al and further in view of the newly cited U.S. Patent 5,861,222 to Fischer et al.

Claims 19 and 20 ultimately depend from claim 17. Accordingly, applicants submit that these claims are patentable for the same reasons as discussed above in connection with claim 17.

In view of the above, applicants submit that EP '638, JP '571, Nishimura et al and Fischer do not disclose or suggest the subject matter of the claims 19 and 20 and, accordingly, request withdrawal of this rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

Sheldon I. Landsman

Sheldon I. Landsman
Registration No. 25,430

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
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CUSTOMER NUMBER

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